Biological and Clinical Sciences Research Journal
ISSN: 2708-2261
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2022i1.119
*Biol. Clin. Sci. Res. J., Volume, **2022**: 119*
Original Research Article

KHANPUR CANOLA (KN-279); NEWLY APPROVED LONG SILIQUED, BOLD SEEDED, HIGH YIELDING WITH IMPROVED QUALITY, DOUBLE ZERO (00) VARIETY OF RAPESEED (*BRASSICA NAPUS* L.)

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(Received, 11th May 2021, Revised 19th September 2022, Published 30th September 2022)

Abstract: *The promising variety "Khanpur Canola" (KN-279) is an outcome of hybridization (KN-120 × Shiralli) during 2006-07 and chosen through Pedigree strategy for determination. Homozygous descendants were built in 2014-15 for yield assessment. Its exhibition was assessed in on station, micro yield preliminaries and national level Uniform Rapeseed Yield Preliminary trials. It has demonstrated its worth in all yield preliminaries and its exhibition is superior to every one of the current developed selections. Its greatest yield of 3400 kg/ha was accomplished in NURYT 2018-19. It produced 22% higher yield in micro yield trials against standard variety during 2016-17. It surpassed the check (Faisal Canola) with 21% better return in National Uniform Rapeseed Yield trials in 2017-18. Similarly, in NURYT 2018-19 KN-279 gave 19% higher seed yield than the check hybrid Hyola 401.Khanpur canola is a striking cultivated new endorsed variety (assortment) having great qualities and reasonable for edible oil creation. It has the erucic acid; 4.04 % and Glucosinolates; 17.20 µ mole/g oil and it gives 40-46 % edible oil content on extraction. Agronomic examinations uncovered that this assortment needs no unique creation innovation bundle and fit in a superior manner with the current agronomic practices. The competitor assortment additionally showed most extreme aphid resistance when contrasted with others following normal agronomical practicesthe actually agronomic practices. It is reasonable for climatic states of both inundated and rain-fed region of the Punjab.*

Keywords: Erucic acid, Glucosinolates, Long silique, double zero, rapeseed, Alternaria Blight, edible oil

Introduction

Edible oil is indispensable piece of human eating routine and contributes crucial job for legitimate developmental events and guideline of various body capabilities. Oilseed crops are the main source of edible oil. Pakistan is deficient in edible oil and spending huge foreign exchange on its import. The import bill of edible oil and oilseeds has crossed Rs. 475 billion (3.068 billion US dollars) during 2019-20. The local edible oil production is only 13% as compared to the import (i.e. 87%) hardly 1/3rd of our requirements. The gap among its synthesis and utilization of edible oil is as yet expanding because of expansion in populace, expansion in per capita utilization and slow expansion in nearby creation of oilseed crops (Economic Survey of Pakistan, 2020-21). Crops like Rapes and Mustard are core source of edible oil and traditionally grown as oil-seed crop in the country. Rapeseed is a gorgeous cradle of oil and protein. It contains 40-44 % good quality oil and its meal has 38-40 % protein that has a complete profile of amino acids including lysine, methionine and cystine. Rapeseed and Mustard seed having Erucic acid less than 5% and Glucosinolates less than 30 µ moles/g in oil free meal is called Double Zero (00) varieties (Aftab*et al.* 2021). The oil from Rapeseed (00) is safe for human consumption and meal is suitable for animals and birds especially for poultry industry. Pakistan produced 38 thousand tonnes of Canola seed from an area of 68 thousand acres during 2019-20 (Mahmood *et al.* 2019). During 2019-20, more than 30,000 acres of Canola crop has been cultivated in the Punjab (Economic Survey of Pakistan, 2019-20).

This is need of time to develop new double zero rapeseed/mustard varieties because the hybrids grown in Pakistan are direct introduction and mostly possessing less adaptability in local climatic conditions. The price of these hybrids is very high compared with price of locally developed rapeseed/mustard varieties. The exotic hybrids are

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also vulnerable to aphid attack due to longer vegetative phase. Traditionally grown varieties of rapeseed/ mustard have high Erucic acid and Glucosinolates content. Considering oilseeds requirement, it is necessary to develop new high yielding rapeseed/mustard varieties having good quality oil that can replace the existing rapeseed/mustard varieties. The Oil-seeds Research Station, Khanpur is building enthusiastic efforts to advance and bring together new Rapeseed (00) varieties in at national level in Pakistan. The presentation of very first double zero rapeseed variety of this Station "KHANPUR CANOLA" (KN-279) will surely assist the cultivators with expanding quality edible-oil creation which will at last diminish the import bill. It would at last give assistance in diminishing the hole between the creation and utilization of good quality consumable oil.

Methodological development

Name of the variety

The name proposed is “KHANPUR CANOLA” subject to its approval.

Parentage/Pedigree

Shiralli a high yielding line with good quality oil and well adapted to Pakistani climatic conditions and KN-120 were sown at field of Oil-seeds Research Station in Khanpur. On flowering, KN-120 was used as female in grossing with Shiralli. The F1 plants were developed and selfed at blossoming. From F2 stage, 135 single plants with early development and great plant power were reaped independently. 78 out of these 135 single plant choices were utilized to develop F3 descendant’s lines. 49 plants were reaped independently from the chosen progeny-rows based on plant wellbeing and better return (yield). Out of these chosen plants 34 single plants were additionally developed to have plant to descendant’s progeny rows of F4. Then, 27 beneficial single plants were reaped from the chose progeny rows. The F5 containing 27 plants to push offspring were developed consequently 21 descendants columns were chosen to develop F6. The 11 single plants were additionally chosen to develop F7. Eleven predominant lines of F7 were chosen. Based on quality examination 3 lines were chosen for assessment in Station yield-trials. The isolating material F2 to F7 was kept up with in disconnection passages to stay away from any unfamiliar pollen pollution. The best performing lines were assessed in Micro Yield-trials. After assessment in these Micro Yield trails, KN-279 was assessed in National Uniform Rapeseed Yield Trials for sequential two years 2017-18 and 2018-19.

Species: *Brassica napus* L.

Breeding History

2006-07 (Initial Cross)	KN-120 × Shiralli
2007-08 (F_1)	Single plants were sown and self-pollinated at following.
2008-09 (F_2)	F_2 generation was grown 135 single plants were selected and each plant was harvested separately.
2009-10 (F_3)	78 progeny rows were grown 49 desirable single plants were reaped from selected lines.
2010-11 (F_4)	34 plant to progeny rows were grown 27 anticipated single plants were picked from selected-rows and Erucic acid and Glucosinolates analysis was performed.
2011-12 (F_5)	27 plant-progeny rows were planted 21 single plants were selected
2012-13 (F_6)	21-plant-to-progeny rows were sown 11 single plants were harvested followed by Analysis of Erucic acid & Glucosinolates of these plants
2013-14 (F_7)	11 plant to progeny rows were grown 8 superior rows were selected. Erucic acid & Glucosinolates of these rows were determined
2014-15 to 2015-16	3 selected lines were evaluated in station yield trial Erucic acid & Glucosinolates contents were determined at the end.

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2016-2017 Selected lines were evaluated in replicated trial (Micro Yield Trial of rapeseed)

↓

2017-18 Evaluation of KN-279 for 1st year in NURYT

Agronomic and plant protection trials were also conducted.

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2018-19 Evaluation of KN-279 for 2nd year in NURYT conducted& Data Compilation

Results & discussion

Adaptability Studies/Yield Performance Trials

The candidate variety Khanpur Canola (KN-279) has been evaluated in the irrigated areas under diverse agro-climatic regions of Punjab. Yield data under different sets of environment is given below.

The candidate variety Khanpur Canola (KN-279) was tested in Preliminary Yield Trial and Advanced-Yield-Trial conducted at Oilseeds Research Station, Khanpur in 2014-15 -to- 2015-16. The yield statistics of these trials are offered in the following table below.

Station Yield Trials

Table-1-Yield Performance of KN-279 in station yield trials at ORS. Khanpur

Variety	Seed-Yield (kg/ha)			
	PYT (2014-15)	AYT (2015-16)	Avg.	% increase
KN-279	2654	2840	2747	
Punjab Canola (C)	2613	-	2613	5%
Faisal Canola(C)	-	1872	1872	46%

The above data of on-station yield trials clearly reflected that KN-279 produced 5% and 46% in PYT and AYT respectively more seed yield than check varieties.

Out Station Yield Trials

Table-2-Yield performance of KN-279 in Micro Yield Trial, 2016-17

Sr. No.	Locations	Seed-Yield (kg/ha)		
		KN-279	Faisal Canola (C)	RohiSarson (C)
1	**Faisalabad**	1963	1407	1333
2	**Bahawalnagar**	1636	1667	1667
3	**Bahawalpur**	2519	1852	1804
4	**Gujranwala**	2589	2007	1796
5	**Khanpur**	2346	1512	1713
6	**Chakwal**	432	519	456
7	**Karor**	1718	1905	1754
8	**Piplan**	1528	1164	1713
	Average	1841	1504	1529
	% increase		22%	

The average seed yield of candidate variety KN-279 at eight locations, has shown 22% increase in yield than Faisal Canola as presented in above table.

Table-3 (i)-Yield performance of KN-279 in NURYT, 2017-18 in Pakistan

Variety/ Lines	Seed Yield (kg/ha)												
	NARC .Isd	BARI. Chk	ORI.F sd	RARI .Bwp	Pioneer Sahiwal	ORS Kpur	BARS DI-Khan	AZR C	AZRI Bhaka r	NIFA	ARI T-jam	ARI Quett a	Mean
KN-279	2782	562	2567	3400	2911	1315	767	2831	2207	2289	1423	760	**1985**
Hyola-401(C)	3051	544	2354	2644	2306	1074	624	2380	1404	3053	1228	865	**1794**
F. Canola (C)	2543	679	1991	2489	2156	1259	470	2446	2111	2042	1234	687	**1676**

10 % increased of KN-279 than Hyloa-401(C) and 18 % increased of KN-279 than Faisal Canola (C)

Table-3 (ii) Complete for reference- Yield performance of KN-279 in NURYT, 2017-18 in Pakistan

Rank	Entry/Name	NARC. Isd	BARI Chk	ORI. Fsd	RARI Bwp	Pioneer Sahiwal	ORS Kpur	BARS DI-Khan	AZRC	AZRI Bhakar	NIFA	ARI T-jam	ARI Quetta	Mean
1	KN-279	2782	562	2567	3400	2911	1315	767	2831	2207	2289	1423	760	1985
2	KN-294	2580	642	3019	3278	3328	889	567	2395	2170	2045	1828	483	1935
3	MUN-1	2582	623	2315	2978	3289	1167	681	2479	2756	2282	845	1042	1920
4	HC-021C	3189	612	2663	2892	2628	926	499	1876	1804	3516	953	1196	1896
5	WS-520	3242	446	1880	1850	2878	781	640	3021	3367	2608	906	1116	1895
6	CHS-2	3311	975	2428	2389	2633	1148	681	2795	2111	2476	905	838	1891

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7	RR-41-4	2801	633	2274	2811	3200	1222	711	2343	2431	2312	1419	487	1887
8	RBN-13028	2851	753	2969	2661	2711	1444	770	1994	1944	2236	1265	696	1881
9	011-K-16-3	3203	489	2374	3228	2522	1019	631	2188	2074	2536	1376	824	1872
10	Kingola	3026	761	2294	2100	2028	796	499	2807	3067	2925	1136	511	1829
11	Hyola-401(Std.)	3051	544	2354	2644	2306	1074	624	2380	1404	3053	1228	865	1794
12	CHS-9	2759	839	2480	2006	2467	963	686	2410	1915	2779	928	644	1740
13	Chakwal Sarson	2213	508	2174	3333	2544	722	358	1922	2344	2060	1756	888	1735
14	MUN-2	2537	646	2430	2617	2817	1167	710	1932	2000	2231	1019	635	1728
15	HC-022B	2458	637	2669	2283	2761	722	444	1909	1684	2982	1150	766	1705
16	CHS-16	2674	569	1817	2311	2778	981	458	2359	2067	2127	1208	874	1685
17	14CBN-009	2390	609	2100	3378	3133	1204	762	1842	2037	1027	1067	653	1684
18	F. Canola (C)	2543	679	1991	2489	2156	1259	470	2446	2111	2042	1234	687	1676
19	RBN-13029	2498	614	2039	2122	2483	1296	564	2380	1522	2030	1385	813	1662
20	MUN-3	2532	557	2043	1739	3206	1056	628	1934	1922	1946	886	1010	1622
21	14CBN-001	2428	499	2215	2047	2583	1185	435	2099	1356	1508	1289	846	1541
22	MUN-4	2528	744	1731	1556	2172	1148	478	1900	1859	2016	1025	569	1477

Table-4 (i)-Yield performance of KN-279 in NURYT, 2018-19 in Pakistan

Variety/ Lines	Seed Yield in kg/ha											
	NARC	BARS F-Jang	ORS, Kpur	NIA, T-Jam	NIFA	RARI, B-pur	BARI, Chk	AZRC, DIK	ORI, FSD	ARI, T-Jam	AZRI, Bhakar	Mean
KN-279	**3083**	**788**	**1056**	**236**	**2108**	**1555**	**1976**	**2801**	**2259**	**922**	**844**	**1603**
Hyloa-401 (C)	1825	625	1370	245	2498	1250	1192	1888	2407	961	927	**1381**

16 % increased of KN-279 than Hyloa-401(C)

Table-4 (ii) Complete for reference- Yield performance of KN-279 in NURYT, 2018-19 in Pakistan

Rank No	De-code	NARC	BARS F-Jang	ORS, Kpur	NIA, T-Jam	NIFA,	RARI, B-pur	BARI, Chk	AZRC, DIK	ORI, FSD	ARI, T-Jam	AZRI, Bhakar	Mean
7	RBN-13016	2698	708	1574	378	3273	1695	2155	1883	3141	1797	1476	**1889**
3	RR-8-1	2845	753	1852	326	2914	1555	1665	2689	3204	1692	1191	**1881**
1	WS-520	2501	809	1444	290	3320	1278	2834	2512	3056	1067	813	**1811**
11	CHS-9	2760	663	1315	275	3746	1055	1808	2274	3185	1336	1059	**1768**
5	16147	2175	747	1444	319	2857	1722	1802	2538	2704	1751	944	**1727**
9	RM 193-1	2852	670	1407	421	2987	1705	1580	2273	2644	1520	969	**1693**
8	KN-294	2526	688	1204	404	3320	1483	1553	2355	2833	1143	983	**1681**
17	RBN-13017	2579	615	1444	232	3320	1472	1993	2047	3026	683	969	**1671**
4	KN-309	2817	753	1352	454	2764	1472	1631	2616	2715	862	934	**1670**
16	CHS-2	2889	622	1259	328	3540	1138	1881	1698	2585	1363	910	**1656**
13	S. Canola (C)	2741	660	1519	282	2781	1222	2052	1802	2667	1117	1045	**1626**
6	RR-14-4	2571	719	1093	489	2441	1417	2229	2183	2378	1143	1045	**1610**
19	Kingola-3	3186	615	741	302	3673	833	2158	1913	2352	1076	830	**1607**
2	KN-279	3083	788	1056	236	2108	1555	1976	2801	2259	922	844	**1603**
20	14CBN009	2135	615	1315	283	3107	1055	2035	2063	2259	1389	1087	**1577**
12	ZCA-13	2222	660	1333	297	2654	1295	2128	1910	2733	939	837	**1546**
23	27902	2671	583	852	486	3197	895	1778	2174	2407	1217	653	**1538**
18	CHS-30	2780	615	1130	228	3413	1055	181	1474	2381	1103	774	**1526**
10	CHS-26	2584	667	778	529	2338	888	1885	2473	2600	1158	868	**1524**
22	C-1	3009	594	1167	352	2431	888	1458	2276	2407	988	972	**1494**
24	CHS-16	2540	517	778	323	2930	888	1559	2274	2385	814	878	**1444**
15	Hyloa-401 (C)	1825	625	1370	245	2498	1250	1192	1888	2407	961	927	**1381**
21	1720	2328	597	859	436	1299	1000	1631	2563	2300	1036	1208	**1374**
14	24225	2538	625	870	277	2624	1083	1485	1750	2074	611	1156	**1372**
Mean		**2619**	**663**	**1215**	**341**	**2897**	**1229**	**1846**	**2183**	**2602**	**1154**	**974**	**1611**

Quality Characteristics

A striking cultivated new line having great qualities, reasonable for edible-oil creation. The promising strain KN-279 has the erucic corrosive 4.04 % and Glucosinolates 17.20 µ mole/g oil free dinner and it has 40-46 % consumable/edible oil.

Table-5-Qualitative analysis of promising strain

Tests	Oleic acid (ʊ-9)%	Linoleic acid% (ʊ-6)	alpha-Linolenic acid% (ʊ-3)	Erucic Acid%	Glucosinolates (µmole/g oil free meal)
KN-279	52.74	20.64	9.27	4.04	17.20

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Faisal Canola (C)	56.73	18.05	8.63	2.81	29.53
Super Canola (C)	61.09	19.09	8.57	2.63	28.20
Canola Oil Standards*	**50-66**	**16-30**	**6-14**	**< 5**	**< 30**

*References

1. Codex Alimentarious Commission, Joint FAO/WHO FAT & oil Standards, United Nations, UK.
2. Australian oilseeds federation incorporated, quality standards, 2015-16.

Spot Examination

Spot examination committee on 23-02-2021 evaluated this strain. The Khanpur canola (KJ-279) was approved by Experts Sub-committee in its 81st meeting and recommended for general cultivation all over Punjab for edible oil production.

DUS Studies

DUS Studies has been completed during the years 2018-19 and 2019-20

Recommended Area for Cultivated

Whole Punjab.

BNS/Pre Basic and Basic Seed Availability

S. No.	Organization/Institute	Seed Availability
1.	Oilseeds Research Station, Khanpur.	200 kg

Justification for Approval

- KN-279 is a high yielding, long silique, bold seeded and early maturing 00 strain.
- Siliques are longer than Super Canola.
- Good quality oil and meal.
- Tolerant against diseases (Alternaria blight and White rust).
- Maximum tolerance against Aphid

BOTANICAL DESCRIPTION AND OTHER CHARACTERISTICS OF KN-279

1.1	NAME OF VARIETY	**Khanpur Canola**
1.2	PREVIOUS NAME	**KN-279**
1.3	CROP	**Rapeseed**
1.4	BOTANICAL NAME	***Brassica napus* L.**
1.5	MAIN USE	**Edible oil**
1.6	VARIETY COMPARED	**Rohisarson**
1.7	PARENTAGE	**KN-120 × Shiralli**
1.8	PEDIGREE	**ORS-2023-3035-4018-5009-6005-bulk-(KN-279)**
2.1	BREED. CENTRE	**Oilseeds Research Station, Khanpur.**
2.2	BREEDER (S)	**Muhammad Aslam Nadeem** **Idrees Ahmed** **Saira Saleem**
	ALLIED DISCIPLINES	**Dr. Hafiz Zia Ullah Khan** **Dr. Fida Hussain**
2.3	APPLICANT	**Rapeseed Botanist**
2.4	MAINTAINER	**Idrees Ahmad**
2.5	AREA ADAPTATION	**Irrigated and Rainfed areas of Punjab**
2.6	COUNTRY/ORIGIN	**Pakistan**
2.7	INSTT/ ORGANIZATION	**Oilseeds Research Station, Khanpur**
3.1	MATURITY DAYS	**152-167 days**
3.2	MATURITY DURATION	**Medium**
3.3	CROP SEASON	**Rabi**
3.4	SOWING TIME	**1st fortnight of October**
SEEDLING CHARACTERISTICS		
4.1	GROWTH HABIT	**Erect**
4.2	SDL ANTHOCYAN	**Medium to Strong**
PLANT CHARACTERISTICS		
5.1	PLANT HEIGHT (cm)	**175 – 215**
5.2	PLANT TYPE	**Indeterminate**
5.3	GROWTH HABIT	**Indeterminate**
5.4	PLANT COLOUR	**Dark green**
LEAF CHARACTERISTICS		
6.1	LEAF COLOUR	**Dark green**
6.2	LEAF ATTITUDE	**Semi Erect**
6.3	LEAF SIZE	**Large**
6.4	PETIOLE BASE	**Broad**
6.5	PETIOLE LENGTH (cm)	**19–24**
6.6	LEAF LOBING	**Deeply lobed**
6.7	LF MARGIN INDNT	**Medium**
6.8	TERMINAL SEGM	**Large**
6.9	LEAF HAIRS	**Absent**

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6.10	LF AURICLES	**Absent**
6.11	LEAF ANTHOCY	**Absent**
6.12	LF ATTACHMENT	**Stalked**
STEM CHARACTERISTICS		
7.1	STEM SHAPE	**Roundish**
7.2	STEM THICKNESS (mm)	**21-24**
7.3	STEM STIFFNESS	**Stiff**
7.4	STEM PITH	**Thick**
7.5	RAMIFICATION	
FLOWER CHARACTERISTICS		
8.1	DAYS TO FLOWERING	**74-79 Days**
8.2	EARLIER THAN	**Faisal Canola**
8.3	FLO'NG DURATION	**Long**
8.4	PETAL COLOUR	**Yellow**
8.5	ANTHER DOTTING	**Absent**
8.6	POLLINATION	**Self**
SILIQUE CHARACTERISTICS		
9.1	SILIQUE SHAPE	**Long**
9.2	SILIQUE ANTHOCYAN	**Absent**
9.3	SILIQUE ATTITUDE	**Horizontal**
9.4	BEAK SHAPE	**Conical**
9.5	SHATTERING	**Medium**
SEED CHARACTERISTICS		
10.1	SEED COLOUR	**Dark Black**
10.2	SEED SIZE	**Medium**
10.3	RETICULATION	**Absent**
10.4	GLUCOSINOLATES	**17.2 µ m/g oil free meal.**
10.5	ERUCIC ACID%	**4.04**
10.6	MEAL PROTEIN	**21-25**
10.7	000 SEED WEIGHT (g)	**4.7**
10.8	AVERAGE YIELD	**2350**
10.9	YIELD POTENTIAL	**3244**
10.10	OIL %	**43-46**
RESISTANT TO		
11.1	LODGING	**Resistant**
11.2	BLACK LEG	**Resistant**
11.3	MILDEW	**Tolerant**
11.4	APHIDS	**Resistant**

Distinguish characters

Early maturity, long Silique size and resistant to Aphid attack

Conflict of interest

The authors declared absence of conflict of interest

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[Citation: Ahmad, I., Saleem, S., Ghazali, H.M.Z.U., Masood, S.A., Jamil, M., Faheem, U., Hussain, F. (2022). Khanpur canola (KN-279); newly approved long siliqued, bold seeded higher yielding with improved quality, double zer0 (00) variety of rapeseed (*Brassica napus* L.). *Biol. Clin. Sci. Res. J.,* **2022***: 119*. doi: https://doi.org/10.54112/bcsrj.v2022i1.119]

[Citation: Ahmad, I., Saleem, S., Ghazali, H.M.Z.U., Masood, S.A., Jamil, M., Faheem, U., Hussain, F. (2022). Khanpur canola (KN-279); newly approved long siliqued, bold seeded higher yielding with improved quality, double zer0 (00) variety of rapeseed (*Brassica napus* L.). *Biol. Clin. Sci. Res. J.*, **2022***: 119*. doi: https://doi.org/10.54112/bcsrj.v2022i1.119]